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DELAMAR MOUNTAINS/EVERGREEN G-E-M RESOURCES AREA

(GRA NO. NV-25)

TECHNICAL REPORT

(WSA NV 050-0177, 050-01R-16A, 050-01R16-B,
and 050-01R-16C)

Contract YA-554-RFP2-1054

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Final Report

April 29, 1983

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY 1

I. INTRODUCTION 2

II. GEOLOGY 9

  1. PHYSIOGRAPHY 9

  2. ROCK UNITS 10

  3. STRUCTURAL GEOLOGY AND TECTONICS 11

  4. PALEONTOLOGY 12

  5. HISTORICAL GEOLOGY 12

III. ENERGY AND MINERAL RESOURCES 14

 A. METALLIC MINERAL RESOURCES 14

  1. Known Mineral Deposits 14

  2. Known Prospects, Mineral Occurrences and Mineralized Areas 14

  3. Mining Claims 14

  4. Mineral Deposit Types 14

  5. Mineral Economics 14

 B. NONMETALLIC MINERAL RESOURCES 14

  1. Known Mineral Deposits 14

  2. Known Prospects, Mineral Occurrences and Mineralized Areas 14

  3. Mining Claims, Leases and Material Sites 15

  4. Mineral Deposit Types 15

  5. Mineral Economics 15

Table of Contents cont.

Page

C. ENERGY RESOURCES 16

Uranium and Thorium Resources 16

1. Known Mineral Deposits 16

2. Known Prospects, Mineral Occurrences and Mineralized Areas 16

3. Mining Claims 16

4. Mineral Deposit Types 17

5. Mineral Economics 17

Oil and Gas Resources 17

1. Known Oil and Gas Deposits 17

2. Known Prospects, Oil and Gas Occurrences, and Petroliferous Areas 17

3. Oil and Gas Leases 18

4. Oil and Gas Deposit Types 18

5. Oil and Gas Economics 19

Geothermal Resources 19

1. Known Geothermal Deposits 19

2. Known Prospects, Geothermal Occurrences, and Geothermal Areas 19

3. Geothermal Leases 19

4. Geothermal Deposit Types 19

5. Geothermal Economics 20

D. OTHER GEOLOGICAL RESOURCES 20

E. STRATEGIC AND CRITICAL MINERALS AND METALS 21

Table of Contents cont.

Page

IV. LAND CLASSIFICATION FOR G-E-M RESOURCES POTENTIAL ... 22

  1. LOCATABLE RESOURCES 23

    a. Metallic Minerals 23

    b. Uranium and Thorium 24

    c. Nonmetallic Minerals 25

  2. LEASABLE RESOURCES 25

    a. Oil and Gas 25

    b. Geothermal 26

    c. Sodium and Potassium 26

  3. SALEABLE RESOURCES 26

V. RECOMMENDATIONS FOR ADDITIONAL WORK 27

VI. REFERENCES AND SELECTED BIBLIOGRAPHY 28

Table of Contents cont.

LIST OF ILLUSTRATIONS

		Page
Figure 1	Index Map of Region 3 showing the Location of the GRA	4
Figure 2	Topographic map of GRA, scale 1:250,000	5
Figure 3	Geologic map of GRA, scale 1:250,000	6

CLAIM AND LEASE MAPS (Attached)

- Patented/Unpatented
- Oil and Gas

MINERAL OCCURRENCE AND LAND CLASSIFICATION MAPS (Attached)

- Metallic Minerals
- Uranium and Thorium
- Nonmetallic Minerals
- Oil and Gas
- Geothermal

Level of Confidence Scheme

Classification Scheme

Major Stratigraphic and Time Divisions in Use by the U. S. Geological Survey

EXECUTIVE SUMMARY

The Delamar Mountains/Evergreen Geology-Energy-Minerals (GEM) Resource Area (GRA) includes the following Wilderness Study Areas (WSAs): NV 050-0177, NV 050-01R-16A, NV 050-01R-16B and NV 050-01R-16C. The GRA is located in south-central Lincoln County, Nevada just east of U. S. Highway 93.

The major feature of the GRA and that which the WSA encompasses is the southern portion of the Delamar Mountains which geologically is composed of 200 to 600 million year old sediments overlain by less than 60 million year old volcanics, giving the southern range a mesa-look. The northeastern portion of the WSA exhibits remnants of a collapsed caldera complex in the volcanic rocks.

There are no known metallic resources in the WSAs. The only nonmetallic which has been mined is sand and gravel along the highway, but quartzite and limestones are also present in considerable volumes. There are no known strategic and critical minerals in the GRA.

There are no patented or unpatented claims in the GRA. Nearly all of the GRA has been leased for oil and gas, but there are no geothermal leases.

The available information contains no evidence indicating favorability for metallic mineral resources within the area, however, there is a lack of information on the area as well. The exposed Paleozoic sediments are classified as having a very low favorability with a low confidence level. The area covered by both volcanic rock and alluvium however is considered to have only a low favorability but with a very low confidence level because there is no evidence suggesting mineralization.

The nonmetallics have a moderate favorability with a moderate confidence level for sand and gravel in the alluvium, silica in the form of quartzite and limestone in the Paleozoic sediments, and a low favorability for perlite in the volcanic rocks. There is a moderate favorability for oil and gas where a prospective section is thought to exist, but only a low favorability where the section is less prospective. The entire GRA is within the "Overthrust Belt" which extends southward from Wyoming into Nevada. There is low favorability for low-temperature geothermal resources in the GRA.

All of the WSAs have low favorability for uranium and very low favorability for thorium with low confidence.

Since very little is known of this area, geologically, there is a need for more detailed information.

I. INTRODUCTION

The Delamar Mountains/Evergreen G-E-M Reources Area (GRA No. NV-25) contains approximately 280,000 acres (1,100 sq km) and includes the following Wilderness Study Areas (WSAs):

WSA Name	WSA Number
Delamar Mountains	NV 050-0177
Evergreen	NV 050-01R-16A
	NV 050-01R-16B
	NV 050-01R-16C

The GRA is located in Nevada within the Bureau of Land Management's (BLM) Caliente Resource Area, Las Vegas district. Figure 1 is an index map showing the location of the GRA. The area encompassed is near 37°15' north latitude, 115°00' west longitude and includes the following townships:

T 7 S, R 63,64 E
T 9 S, R 61-64 E
T 11 S, R 61-64 E
T 8 S, R 62-64E
T 10 S, R 61-64 E

The areas of the WSAs are on the following U. S. Geological Survey topographic maps:

7.5-minute:

Delamar Lake
Pahranagat Lake
Delamar, NE
Delamar, SE
Gregerson Basin
Delamar 3, NW
Delamar, SW
Lower Pahranagat Lake SE

The nearest town is Alamo which is located approximately five miles northwest of the northwest corner of the GRA along U.S. Highway 93. Access to the area is via U.S. Highway 93 to the west and the Kane Springs Wash road to the east. Access within the area is via dirt roads and trails peripheral to the WSA.

Figure 2 outlines the boundaries of the GRA and the WSAs on a topographic base at a scale of 1:250,000.

Figure 3 is a geologic map of the GRA and vicinity, also at 1:250,000. At the end of the report, following the Land Classification Maps, is a geologic time scale showing the various geologic eras, periods and epochs by name as they are used in the text, with the corresponding age in years. This is so that the reader who is not familiar with geologic time subdivisions will have a comprehensive reference for the geochronology of events.

This GRA Report is one of fifty-five reports on the Geology-Energy-Minerals potential of Wilderness Study Areas in the Basin and Range Province, prepared for the Bureau of Land Management by the Great Basin GEM Joint Venture.

The principals of the Venture are Arthur Baker III, G. Martin Booth III, and Dennis P. Bryan. The study is principally a literature search supplemented by information provided by claim owners, other individulas with knowledge of some areas, and both specific and general experience of the authors. Brief field verification work was conducted on approximately 25 percent of the WSAs covered by the study.

None of the WSAs in this GRA were field checked.

One original copy of background data specifically applicable to this GEM Resource Area Report has been provided to the BLM as the GRA File. In the GRA File are items such as letters from or notes on telephone conversations with claim owners in the GRA or the WSA, plots of areas of Land Classification for Mineral Resources on maps at larger scale than those that accompany this report if such were made, original compilations of mining claim distribution, any copies of journal articles or other documents that were acquired during the research, and other notes as are deemed applicable by the authors.

As a part of the contract that resulted in this report, a background document was also written: Geological Environments of Energy and Mineral Resources. A copy of this document is appended to this GRA report. There are some geological environments that are known to be favorable for certain kinds of mineral deposits, while other environments are known to be much less favorable. In many instances conclusions as to the favorability of areas for the accumulation of mineral resources, drawn in these GRA Reports, have been influenced by the geology of the areas, regardless of whether occurrences of valuable minerals are known to be present. This document is provided to give the reader some understanding of at least the most important aspects of geological environments that were in the minds of the authors when they wrote these reports.

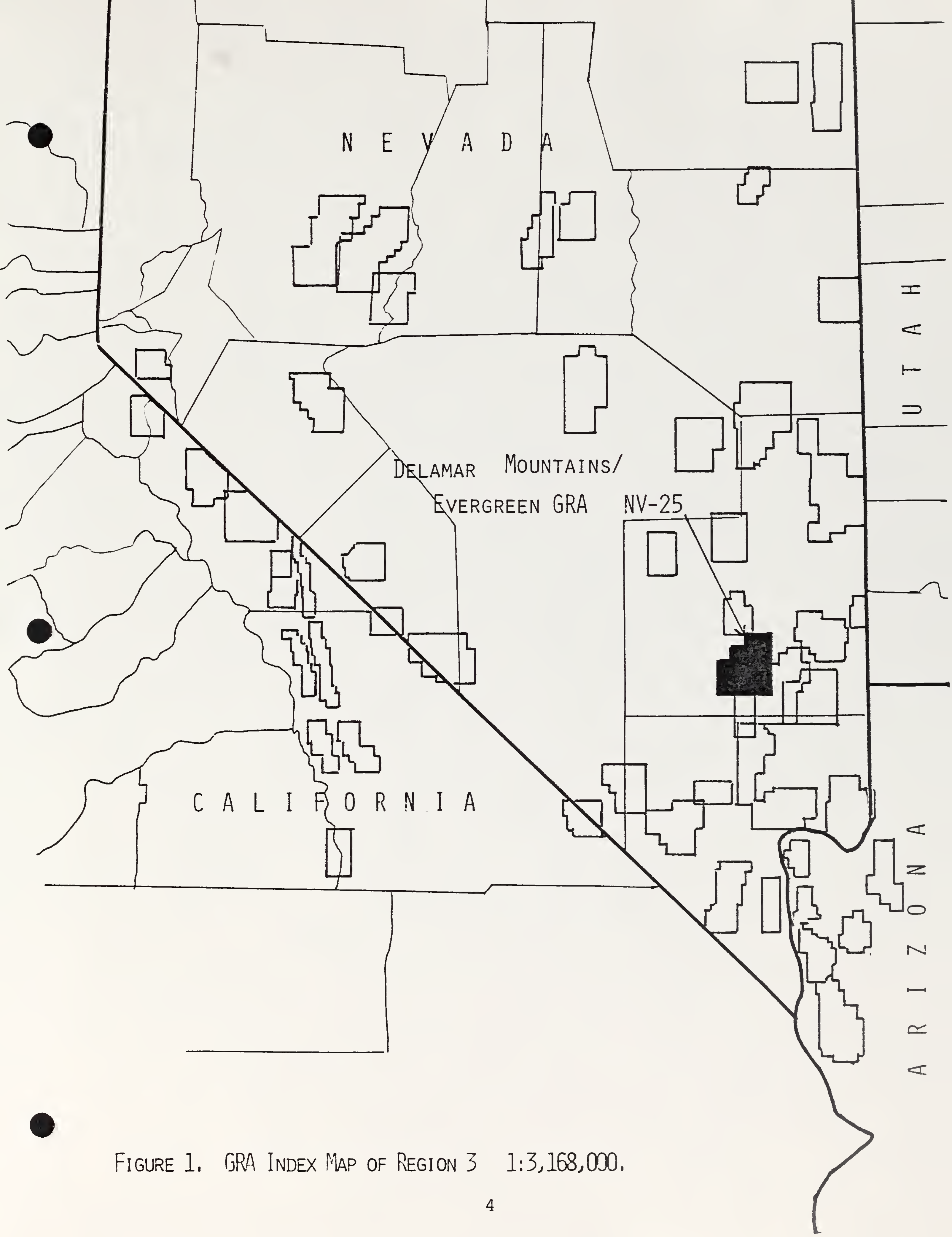
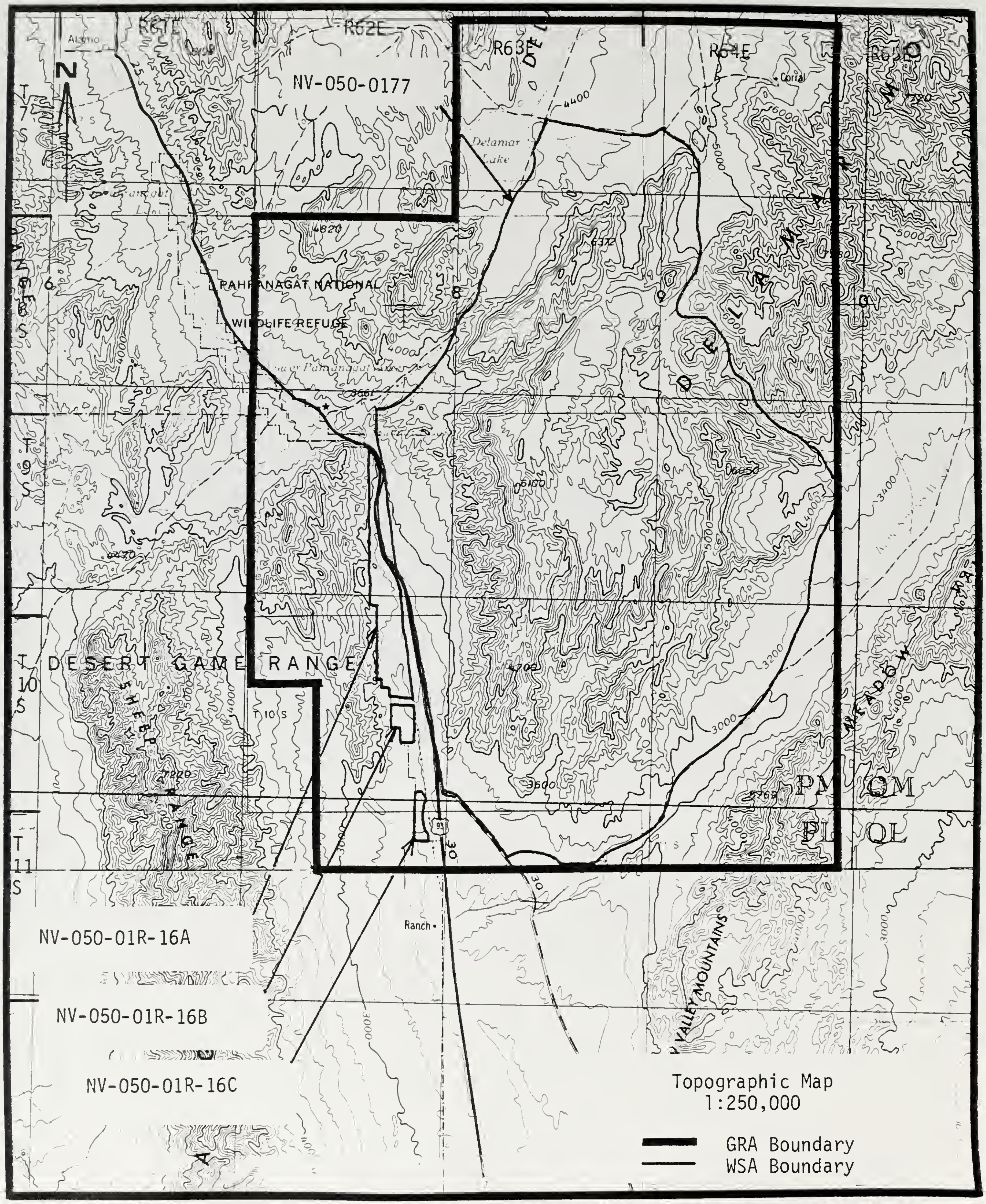


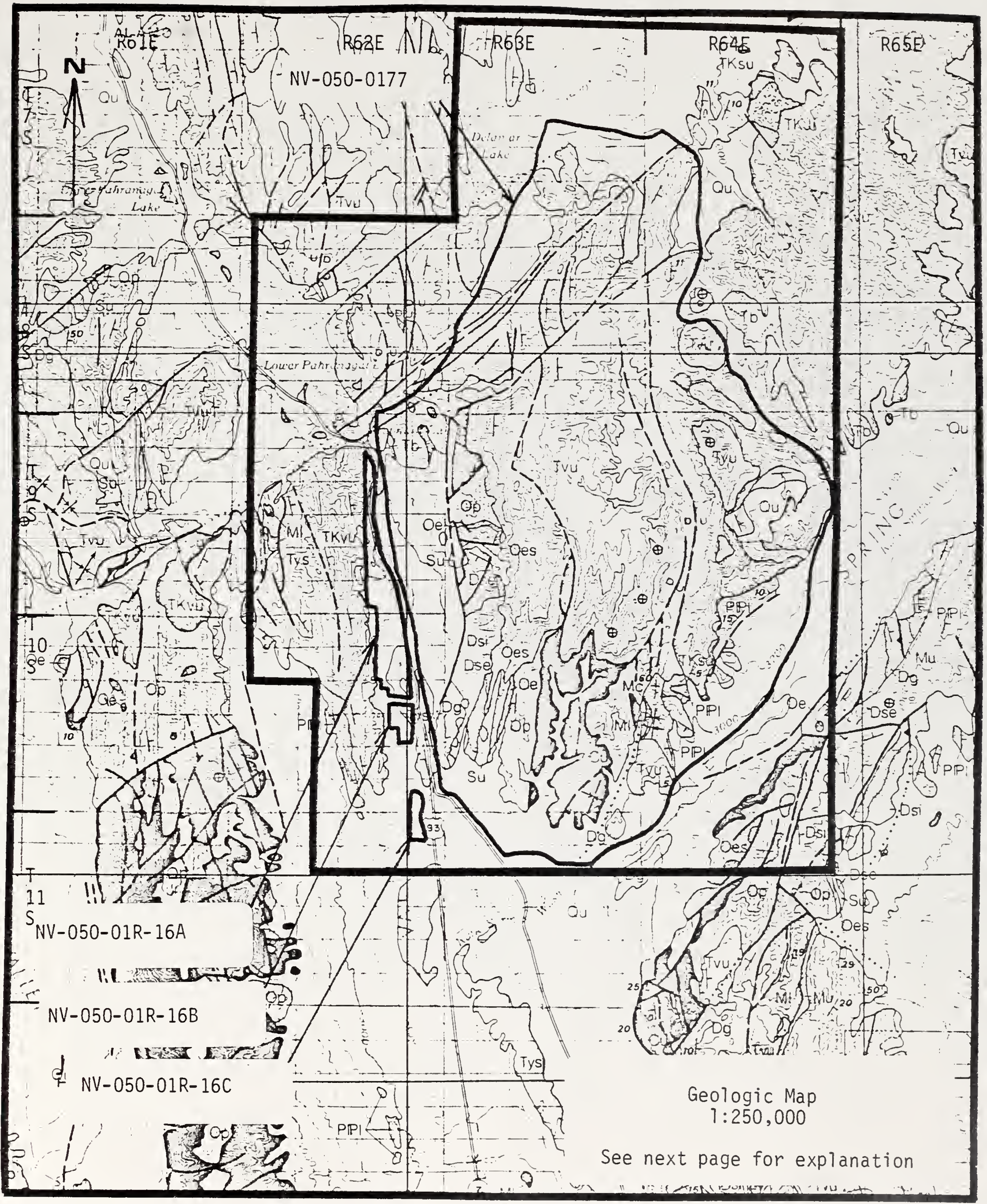
FIGURE 1. GRA INDEX MAP OF REGION 3 1:3,168,000.



Caliente Sheet

Delamar Mountains/Evergreen GRA NV-25

Figure 2



Geologic Map
1:250,000

See next page for explanation

Howard (1978)

EXPLANATION

Cenozoic Sediments

Quaternary, Undifferentiated ([illegible]): *Includes all sedimentary rocks and surface exposures of recent playa deposits, dune sands, lake beds, shoreline deposits and younger as well as certain older exposures of gravels and other alluvium associated with pediments and mountain streams.*

Tertiary Younger Sediments (Tys): *Sedimentary rocks of Miocene and Pliocene age including older lake beds of the Muddy Creek Formation and Panaca Formation in Lincoln and Clark Counties; the Muddy Creek Formation in Southwestern Utah, pre-Quaternary sediments in the White River Valley; and sediments associated with ash-flow tuffs n[illegible] Antelope Summit in White Pine County.*

Tertiary Sediments Undifferentiated (Tsu). *Primarily Miocene and upper Oli[illegible]ene deposits including tuffaceous sediments interbedded [illegible] ash fl[illegible], the Horse Camp Formation and various unidentified tuff[illegible] [illegible] and diatomites in Nye County, intravol[illegible] [illegible] and clastic sedimentary rocks in Lincoln and Nye C[illegible] [illegible]merates and limestones of uncertain age in the [illegible] Ranges and the Cricket Mountains of Utah*

[illegible] Older Sediments (Tos). *Includes the Sheep Pass Formation [illegible] Nye Counties, the Gilmore Gulch Formation in Nye [illegible] lacustrine limestones in southern Lincoln County; [illegible] conglomerates, tuffaceous and clastic sedimentary rocks, [illegible] cherts, claystones, silts, carbonaceous shales and oil shales in Elko County; and older limestones of the Illipah area and the Kinsey Canyon Formation of the Schell Creek and Grant Ranges in White Pine County*

[illegible] Volcanics

[illegible] Basalt (Qb) *Basalt, andesite and [illegible]ite of Quaternary or [illegible] Tertiary age in Nye County.*

Tertiary Basalt (Tb): *Intermediate and basaltic [illegible] including [illegible] [illegible] Basalt Member of the Muddy Creek Formation in Clark County. [illegible] [illegible] and lava cones which are [illegible] parts of the Bar[illegible] Formation and latite flows in Elko [illegible] [illegible] flows and dikes in Lincoln County, andesite and basalt [illegible] of various ages in North Central Nevada, and basalt and basaltic andesite flows in Southwestern Utah.*

Tertiary Volcanics, Undifferentiated (Tvu): *Early to late Tertiary volcanic rocks ranging in composition from silicic to intermediate; primarily rhyolites, dacites, quartz latite flows, ignimbrites and pyroclastics of widespread occurrence. These rocks are listed under various subdivisions in Elko, Lincoln, and Nye Counties; North Central Nevada and Southwestern Utah.*

Tertiary Older Volcanics (Tov): *Pre-Miocene volcanic rocks lithologically similar to Tertiary Volcanics, Undifferentiated (Tvu). Listed under various subdivisions in Nye County.*

[illegible] *mid-Jurassic through late Tertiary. [illegible] intrusions ra[illegible]ng in composition from granitic through [illegible] and in texture from holocrystalline to porphyritic.*

Mesozoic Sediments

Tertiary-Cretaceous Sediments (TKsu) *Conti[illegible]ntal sediments consisting of fanglomerates, clastics, tuffs and [illegible] Includes the Gale Hills Formation and the Overton Fanglomerate*

Cretaceous Sediments (Ks): *Chiefly non-marine siltstone, shale, conglomerate and limestone. Includes lower Gale Hills Formation, Thumb Formation, Baseline Sandstone, Willow Tank and Newark Canyon Formations.*

Jurassic (Ju): *Eolian cross-bedded sandstone in Utah, volcanically derived sediments, ash flows and basic lava flows in northern Elko County. Includes Navajo Sandstone, Aztec Sandstone, Frenchie Creek Formation and Boyer Ranch Formation.*

Jurassic-Triassic (JTRu): *Includes Nugget and Aztec Sandstones and Chinle Formation of southern Nevada*

Triassic (TRu). *Shallow marine sedimentary rocks including Chinle, Shinarump, Thaynes and Moenkopi Formations in the west and continental to shallow marine sediments in the east*

Mesozoic Volcanics

Tertiary-Cretaceous Volcanics (TKvu). *[illegible] in Lincoln County where it covers wide areas of the Clover, Del Mar, Wilson Creek, White Rock and Mahogany Mountains.*

Paleozoic Sediments

Permian, Undifferentiated (Pu) *Sha[illegible] marine intertidal and continental sediments Includes [illegible] [illegible], Plympton Formation, Kaibab Limestone, Pequop Formation, Coconino Sandstone, Arcturus Formation, Rieptown [illegible] Hill Sandstone, Riepe Springs Formation, Carbon R[illegible] [illegible] and Loray Limestone. With the exception of parts of White Pine County, local symbols are used to identify all Perm[illegible]. In White Pine County, local [illegible] used except for [illegible] Group which [illegible] [illegible] and Rib Hill Sandstones ([illegible]) To [illegible] non-standard symbol used for Permian in Utah has been [illegible] the standard "P".*

Penn[illegible]an-Permian (ℙPu): *Marine sandstone and [illegible] places). Includes Rib Hill Sandstone, Riepe [illegible] stone and Ferguson Mountain Formation in southern [illegible] Strathearn Formation, Buckskin Mountain Formation [illegible] Flat Formation and Carlin Canyon Formation in Eureka County; Pablo Formation in Nye County, and Oquirrh Formation or group in Utah. Local symbols are used where possible.*

Pennsylvanian Undifferentiated (ℙu): *Includes Ely Limestone, Moleen and [illegible] Formations. To avoid confusion, the non-standard symbol used for Pennsylvanian in Utah has been replaced by "ℙ".*

Mississippian Upper (Mu) *Includes Diamond Peak [illegible] Spring Formation, Callville Limestone, Scotty Wash Formation, Ochre Mountain Limestone and Manning Canyon Shale in parts of Clark County. Chainman Shale is combined with Diamond [illegible] Formation in some parts of Utah.*

Mississippian, Chainman Shale (Mc): *Includes Mountain City Formation in Elko County and Eleana Formation in Nye County.*

EXPLANATION (continued)

Mississippian, Lower (MI): *Includes Monte Cristo and Rogers Spring Limestones in Clark County; Joana, Mercury and Bristol Pass Limestones in Lincoln County; and Joana Limestone elsewhere.*

Mississippian-Devonian, Undfiferentiated (MDu). *Includes Rogers Spring Limestone and Muddy Peak Limestone in parts of Clark County. Joana Limestone and Pilot Shale in Elko County; Pilot Shale, Joana Limestone, Chainman Shale and Diamond Peak Formation in Eureka and White Pine Counties.*

Mississippian-Devonian, Pilot Shale (MDp): *Shown in combination with other Mississippian Formations in Clark, Elko, parts of Lincoln, Eureka and White Pine Counties.*

Devonian-Cambrian, Undifferentiated (DSOꞒu): *Undivided limestone and dolomite occurring in Lincoln County.*

Devonian-Ordovician, Undifferentiated (DSOu): *Dolomites in Elko and Nye Counties.*

Devonian, Upper (Du): *Primarily Devils Gate and Guilmette Formations. Also includes Sevy and Simonson dolomites in parts of White Pine County. Contains Guilmette Devils Gate, Simonson and Sevy in Elko County under the heading of* Dgd. *Local symbols used where possible.*

Simonson Dolomite (Dsi): *Alternating light to dark gray fine to medium grained dolomite. Included with other Silurian and Devonian sediments in North Central Nevada and parts of Utah. Grouped with Sevy Dolomite in parts of Clark, Elko, Eureka, Nye, and White Pine Counties.*

Sevy Dolomite (Dse): *Very light colored, dense, distinctly bedded unfossiliferous dolomite. Combined with other Devonian and Silurian sediments in parts of North Central Nevada and Utah and with the Simonson Dolomite in parts of Clark, Elko, Eureka, Nye and White Pine Counties.*

Sevy and Simonson Dolomites, combined (Dun): *Also includes the Sultan and Muddy Peak Limestones in Clark County; Nevada Formation in Elko County; Devils Gate Formation in Eureka County; Nevada Formation, Woodpecker Limestone, Oxyolk Canyon Sandstone and Rabbit Hill Formation in Nye County; Nevada Formation and Devils Gate Formation in Eureka County and the Nevada Formation in White Pine County. Local symbols are used where possible.*

Devonian, Western Facies (Dw): *A portion of the western allochthonous assemblage. Includes Woodruff Formation and Slavern Chert in Eureka County and silicious siltstone in the Cockalorum Wash area of Nye County.*

Silurian, Undifferentiated (Su): *Includes Lone Mountain and Laketown Dolomites throughout the mapping area, the Elder Sandstone and Fourmile Canyon formation in Eureka County, and the Roberts Mountain formation in Nye County. In White Pine County, the Silurian deposits are grouped with the upper Ordovician sediments under the heading of Silurian Ordovician, Undifferentiated* (SOu).

Upper Ordovician, Undifferentiated ([illegible]): *Includes Ely Springs and Fish Haven Dolomites and the Hanson Creek Formation. Local symbols are used where possible. Listed as Ordovician, Undifferentiated* (Ou) *in parts of North Central Nevada. In Clark County, Ely Springs Dolomite has been divided from the rest of* Oep *by the author. The Eureka Quartzite and Pogonip Group are grouped with Silurian sediments under the heading Silurian-Ordovician, Undifferentiated* (SOu) *in Elko County.*

Ordovician Eureka Quartzite (Oe) *Light colored vitreous quartzite and hard sandstone. Also includes the Swan Peak Quartzite in parts of Utah In Clark County, the Eureka Quartzite has been separated from* Oep *by the author. In parts of North Central Nevada, the Eureka Quartzite has been grouped with other Ordovician sediments under the heading of* Ou. *In White Pine County, the Eureka Quartzite has been grouped with the Pogonip Group under the heading of*

Ordovician, Pogonip Group (Op): *Limestone, silty limestone shale and interformational conglomerates. In Clark County, the Pogonip Group has been separated from* Oep *by the author Includes the Garden City Limestone in parts of Utah. In White Pine County, the Pogonip Group is grouped the Eureka Quartzite under the heading of* Ol.

Ordovician, Undifferentiated (Ou): *Includes the Pogonip Group, Ely Springs Dolomite, Eureka Quartzite and Comus Formation in North Central Nevada.*

Ordovician, Vinini Formation (Ovi): *Part of the western allochthonous assemblage. Includes Valmy Formation in parts of North Central Nevada. Local symbols are used where possible.*

Cambrian-Ordovician, Undifferentiated (OꞒu): *Occurs in Elko, Eureka, Nye and White Pine Counties as shale and limestone and is usually so identified when metamorphosed to phyllite. Includes the Tennessee Mountain Formation in Elko County, Board Canyon Sequence in North Central Nevada, Windfall Formation in Nye County and the lower Ordovician and post-Dunderberg Shale in the Schell Creek Range of White Pine County In some parts of Nye County,* OꞒu *is metamorphosed to slate and marble instead of phyllite.*

Cambrian, Upper and Middle (Ꞓu): *Primarily limestones dolomites, shales and quartzites Includes Edgemont and Peak Limestones in Elko County; Highland Peak formation, Patterson Pass Shale, Pole Canyon Limestone, Chisholm Shale and Lyndon Limestone member of the Chisholm Shale in Lincoln County; Harmony Formation, Preble Formation, Pioche Shale, Eldorado Dolomitee, Geddes Limestone, Secret Canyon, Hamberg, Dole and Dunderberg Shales, Windfall Formation, and Scott Canyon Formation in North Central Nevada; Windfall Formation, Dunderberg Shale, Tybo Shale and Lincoln Park Formation in Nye County; Notch Peak Formation, Dunderberg Shale, Orr Formation, Weeks Formation, Marjum Formation, Wheeler Shale Swasey Formation, Whirlwind Formation, Dome Limestone, Howell Formation and Tatow Formation in Utah; and Corset Spring Shale, Notch Peak Limestone, Dunderberg Shale and Windfall Limestone in White Pine County. Metamorphosed to schist in Elko County*

Cambrian, Lower (Ꞓpmp): *Primarily Prospect Mountain Dolomite and Pioche Shale. Also includes Tapeats Sandstone, Wood Canyon Formation, Lyndon Limestone, Chisholm Shale and Carrera Formation in Clark County; Sterling Quartzite and Wood Canyon Formation in parts of Lincoln County; Busby Quartzite in the Gold Hill area of Utah and the Stella Lake Quartzite in White Pine County.*

Precambrian

Precambrian Sediments (pꞒs): *Includes the Johnnie Formation Sterling Quartzite and some metamorphics in Clark County; Johnnie Formation and lower units of Prospect Mountain Quartzite in Lincoln County; McCoy Creek Group in Elko County; and the McCoy Creek Group excluding the Stella Lake Quartzite in White Pine County.*

Precambrian Intrusives (pꞒi): *Includes the Gold Butte Granite in Clark County and other undifferentiated igneous and metamorphic rocks, primarily granites and pegmatites.*

II. GEOLOGY

The Delamar/Evergreen GRA lies within the Basin and Range province in central Lincoln County, Nevada. The area includes WSA 050-0177 which contains the southern tip of the Delamar Mountains, and several small WSA's along the eastern flank of the Coyote Springs Hills.

The southern Delamar Mountains consists mainly of Paleozoic sediments (see Figure 3) of the Delamar Mountains thrust plate which have been covered by near horizontal mid-Tertiary volcanics. The eastern extension of the Pahranagat shear zone intersects the northwest portion of the study area. Basin and Range normal faulting, which generally trends in a northerly direction, has further displaced the volcanics and older sediments. The Coyote Springs normal fault, which forms the steep western escarpment of the Delamar Mountains, reportedly has a displacement of about 1,000 feet.

The Coyote Springs Hills, considered to be a part of the Sheep Range to the west, consists primarily of Tertiary volcanics which overlies a thrust sheet of predominantly Paleozoic sediments. The Coyote Springs Hills are terminated in the north by the Menard Lake fault, the southernmost tear fault of the Pahranagat Shear system.

Most of the following description of the geology of the GRA is taken from Tschanz and Pampeyan, 1970.

1. PHYSIOGRAPHY

The Delamar Mountains/Evergreen GRA lies within the Basin and Range province in central Lincoln County, Nevada. The area includes WSA 050-0177 which contains the southern tip of the Delamar Mountains and WSA 050-01R-16A, 050-01R-16B and 050-01R-16C, which include a very narrow strip bordering the Desert National Wildlife Range along the eastern flank of the Coyote Springs Hills and western edge of Coyote Spring Valley.

The Coyote Springs Hills, which is part of the Sheep Range, is a triangular-shaped mass of predominantly Tertiary volcanics with Paleozoic marine sediments exposed in fault blocks.

The southern Delamar Mountains is composed of a major thrust sheet of Paleozoic miogeosynclinal rocks which have been overlain by mid-Tertiary volcanics and displaced by Basin and Range faulting. The Kane Springs Wash caldera complex covers the northeastern portion of the WSA and includes volcanic rocks ranging in age from 17 to six million years old (Stewart, 1980).

The topography is rugged where the Paleozoic sediments occur in the Delamar Mountains. Here the volcanic-covered areas are less dissected, forming a mesa-like summit.

Elevations in the area range from about 3,000 feet in the valleys to over 6,000 feet along the crest of the Delamar range. The majority of the GRA drains into Coyote Spring Valley Wash, a tributary of the Colorado River.

2. ROCK UNITS

Almost a complete Paleozoic section is exposed in the Delamar Mountain thrust sheet in the southern Delamar Mountains (Tschanz and Pampeyan, 1970). The oldest rock units exposed are undifferentiated Middle Cambrian dolomite, limestone and Dunderberg Shale.

The Lower Ordovician Pogonip Group, which consists of alternating thick-bedded cliff forming limestone and thin-bedded slope-forming limestone, is overlain by the Eureka Quartzite. The Eureka Quartzite is comformably overlain by the Ely Springs Dolomite, a dark-gray medium to coarse-grained fossiliferous unit.

Deposited next was the Silurian Laketown Dolomite which generally forms a bold three-part outcrop with dark dolomite sequences above and below a light-gray dolomite.

The Sevy dolomite was unconformably laid down during the lower Ordovician. It consists of a homogenous microcrystalline dolomite which characteristically forms steep step-like slopes. The Simonson Dolomite is the next oldest unit and consists of alternating sequences of dark and light dolomite. The Upper Devonian Guilmette Formation, composed of sandy limestone was deposited next.

Undivided Lower Mississippian limestone, including the Joanna, are the next oldest sediments. These units have been overlain by the Chainman Shale which consists primarily of fissile black carbonaceous shale.

Unnamed, undivided Permian and Pennsylvanian limestone and sandstone were deposited conformably over the Chainman Shale.

Cretaceous(?)-Tertiary clastic unit consisting largely of poorly cemented cobbles and pebbles was deposited next unconformably over older sediments.

The next oldest formation is an assemblage of volcanic rocks consisting of a sequence of light-gray, pinkish or white water-laid or massive airfall pumice, lapilli tuffs, and tuff breccias which were deposited during the mid-Tertiary. They outcrop for the most part in the central portion of the WSA.

Younger Tertiary volcanic rocks covering a portion of the northeastern portion of the WSA were deposited during Miocene and Pliocene time as part of a caldera complex described by Noble (1968) as the Kane Springs Wash Caldera. These rocks are predominantly an ignimbrite series that range in composition from rhyolite to basalt.

It should be noted that the caldera complex does not show on any 1:250,000 maps including that used in this report. It is outlined however in Noble (1968) and Stewart and Carlson (1976 and 1978).

A small intrusive body of diorite emplaced during the mid-Tertiary has been identified along the western border of the GRA in the Coyote Springs Hills. Except for this intrusive body, rocks found in this area are similar to those found in the Delamar Mountains.

Pliocene basalt is the youngest extrusive unit found in the area. Lakebeds consisting largely of siltstone and clay shale were deposited over the older rocks during the upper Pliocene.

Thick older gravels, derived from nearby accumulations of Pleistocene highlands are found in the valleys adjacent to the Coyote Springs Hills and Delamar Mountain Range.

3. STRUCTURAL GEOLOGY AND TECTONICS

Structures identified within the Delamar Mountains/Evergreen GRA consist of folding, thrusts and tear faults related to the Cretaceous Laramide orogeny and Miocene-Pliocene Basin and Range normal faults.

The Delamar Mountains thrust plate, trending slightly east of north, displaced Paleozoic miogeosynclinal formations towards the east. An associated subparallel overturned syncline in the Mississippian and Pennsylvanian rocks lies to the east of the thrust.

The northern extension of the Gass Peak thrust and fold belt terminates in the Coyote Springs Hills close to its intersection with the left-lateral Maynard Lake fault. In the north Mississippian(?) rocks have been thrust over the older rocks. At the south end of the hills the Pennsylvanian rocks are folded into a north-striking syncline, overturned to the east. Longwell (1926) and Tschanz and Pampeyan (1970) both believe that the entire Sheep Range is part of the Gass Peak thrust plate.

The Maynard Lake fault is a northeast-trending left-lateral tear fault that forms the northern termination of the Sheep Range and the Coyote Springs Hills. The Buckhorn left-lateral tear fault is five miles north of and parallel to the Maynard Lake fault. The Arrowhead mine left lateral tear fault is five miles north of the Buckhorn fault and is also subparallel to it. These three tear faults form the Pahranagat shear system. It is postulated by Tschanz and Pampeyan (1970) that approximately thirty miles of right-lateral Laramide movement occurred within the shear system, and that the left-lateral total displacement as great as ten miles in the Pahranagat shear system occurred in post-Miocene times.

The Kane Springs Wash Caldera complex of Late Tertiary formed ring faults and other collapse features and was subsequently filled by additional volcanism.

Basin and Range Miocene-Pliocene normal faults in the study area generally have a northerly trend, however, several normal faults in the Delamar Mountains trend northeast, subparallel to the major Pahranagat shear system.

The west face of the southern Delamar Mountains follows the north-striking Coyote Springs fault, which reportedly has a displacement of about 1,000 feet.

4. PALEONTOLOGY

The majority of the area of the Delamar/Evergreen Mountains GRA is characterized by lithologies unsuitable for the preservation of paleontological resources, with the exception of the central and southwestern parts of the area. Paleozoic marine sediments ranging in age from Cambrian through Devonian occur in a relatively narrow north-south-trending band along the southwest margin of the Delamar Mountains, and the southeastern corner of the study area in the Meadow Valley Mountains, where Tschanz and Pampeyan (1970) cite an early Ordovician occurrence of mollusks from carbonate units possibly equivalent to the Goodwin Limestone. No localities recorded for this area were found in a search of the literature, although the potential for occurrence of paleontological resources is considered high.

Cambrian and Ordovician strata in the Sheep Range contain poorly preserved marine invertebrates occurring discontinuously throughout the area, especially in the Cambrian Pioche Shale (Tschanz and Pampeyan, 1970).

5. HISTORICAL GEOLOGY

Throughout the Paleozoic marine carbonate and clastic sediments of the Cordilleran miogeosyncline were deposited. Mesozoic sediments were also laid down, however, they were largely eroded during the orogenic period that began with uplift in Late Triassic time and culminated in thrust and right-lateral tear faulting during the Cretaceous.

Subsequent to the Laramide orogeny, Oligocene-Early Pliocene intermittent volcanism occurred. The eruption of predominantly ignimbrite sequences accompanying caldera collapse was followed by Basin and Range faulting and left-lateral shearing, after which the Pliocene lake beds were deposited.

The erosion of newly-formed tectonic highlands resulted in the thick accumulation of fanglomerates in the adjacent basins during the Pleistocene.

III. ENERGY AND MINERAL RESOURCES

A. METALLIC MINERAL RESOURCES

1. Known Mineral Deposits

There are no metallic mineral deposits known to exist in the GRA.

2. Known Prospects, Mineral Occurrences and Mineralized Areas

There are no metallic mineral occurrences or prospects known to exist in the GRA.

3. Mining Claims

There are no patented or unpatented mining claims in the GRA according to the BLM's records as of this date.

4. Mineral Deposit Types

Since there are no known metallic minerals in the GRA, a discussion of deposit types is not applicable.

5. Mineral Economics

Since there are no known metallic minerals in the GRA, a discussion of mineral economics is not applicable.

B. NONMETALLIC MINERAL RESOURCES

1. Known Mineral Deposits

There are no nonmetallic mineral resources reported to exist in the GRA except a few borrow pits in the alluvium along the highway on the west side of the GRA. Gundry (1983) has reported that material may have been extracted from some Nevada State Highway Department material sites along and just inside the western border of WSA NV 050-0177, adjacent to U. S. Highway 93. The approximate location of the sites are shown on the Nonmetallics Land Classification and Mineral Occurrence Map.

2. Known Prospects, Mineral Occurrences and Mineralized Areas

Nonmetallic mineral occurrences known in the GRA include potential sand and gravel resources in the alluvial materials. The Eureka Quartzite is part of the Paleozoic sediments exposed along the southern flank of the Delamar Range. This unit has been mined previously for silica sand from similar beds to the south in the Arrow Canyon Range. In addition the limestones at the south end of the range could possible be used in cement or lime manufacture.

3. Mining Claims, Leases and Material Sites

There are no nonmetallic patented or unpatented mining claims in the GRA according to the BLM's records as of this date. Material sites are found in the GRA and are discussed above under deposits.

4. Mineral Deposit Types

The sand and gravel and borrow come from Recent alluvial material which has been deposited by the erosion of the nearby bedrock units. The Paleozoic quartzites and carbonate units are sedimentary rocks.

5. Mineral Economics

Pure limestone and dolomite are used principally to produce lime, but some is used as rock for building stone, crushed rock, and similar applications. The principal uses of lime are in steel smelting, water purification, as an alkali, in paper and pulp manufacture, and sewage treatment. Other uses for lime are in sugar purification, mortar, and as an agricultural soil conditioner. Limestone with certain clay impurities (called cement rock), or purer limestone with clay added, is used to make cement that is consumed mostly in construction. The United States uses about 20 million tons of lime and 85 million tons of cement annually. For both lime and cement the raw material must be mined within a very few miles of the processing plant, because it has a very low value in the form of run-of-mine rock -- two or three dollars per ton. There are numerous lime and cement plants in the United States, and most of them sell most of their product within a 200-mile radius of the plant. Some cement is imported in the form of clinker which is the kiln-fired rock that is then ground in the United States. In the early 1980s the price F.O.B. plant of both lime and cement has been about $40 per ton.

The most common use of sand and gravel is as "aggregate" -- as part of a mixture with cement to form concrete. The second largest use is as road base or fill. About 97 per cent of all sand and gravel used in the United States is in these applications in the construction industry. The remaining three percent is used for glassmaking, foundry sands, abrasives, filters and similar applications. The United States uses nearly one billion tons of sand and gravel annually, all of it produced domestically except for a very small tonnage of sand that is imported for highly specialized uses. Since construction is by far the greatest user of sand and gravel, the largest production is near sites of intensive construction, usually metropolitan areas. Since sand and gravel are extremely common nearly everywhere, the price is generally very low and mines are located very close to the point of consumption -- within a few miles as a rule. However, for some applications such as high-quality concrete there are quite high specifications for sand and gravel, and acceptable material must be hauled twenty miles or more. Demand for sand and gravel fluctuates with activity in the construction industry, and has been relatively low during the recession of the early 1980s. Demand is expected to increase by about one-third by the year 2000. In the early 1980s the price of sand and gravel F.O.B. plant has averaged about $2.50 per ton, but varied widely depending upon quality and to some extent upon location.

The sand and gravel resources in the GRA can be used for nearby construction uses, most likely in road construction.

The present economics, plus abundant similar resources nearby of quartzite and limestone, would indicate little if any interest in development of the Paleozoic sedimentary rocks.

C. ENERGY RESOURCES

Uranium and Thorium Resources

1. Known Mineral Deposits

There are no known uranium or thorium deposits within or near the GRA.

2. Known Prospects, Mineral Occurrences and Mineralized Areas

There are no known occurrences of uranium, thorium or radioactivity in the GRA.

3. Mining Claims

There are no known uranium or thorium claims or leases in the GRA.

4. Mineral Deposit Types

A description of uranium deposit types in the GRA is not possible due to the lack of known radioactive occurrences in the area.

5. Mineral Economics

Uranium and thorium appear to have little economic value in the GRA due to a lack of known occurrences. However, the lack of occurrences may reflect incomplete exploration of the area.

Uranium in its enriched form is used primarily as fuel for nuclear reactors, with lesser amounts being used in the manufacture of atomic weapons and materials which are used for medical radiation treatments. Annual western world production of uranium concentrates totaled approximately 57,000 tons in 1981, and the United States was responsible for bout 30 percent of this total, making the United States the largest single producer of uranium (American Bureau of Metal Statistics, 1982). The United States ranks second behind Australia in uranium resources based on a production cost of $25/pound or less. United States uranium demand is growing at a much slower rate than was forecast in the late 1970s, because the number of new reactors scheduled for construction has declined sharply since the accident at the Three Mile Island Nuclear Plant in March, 1979. Current and future supplies were seen to exceed future demand by a significant margin and spot prices of uranium fell from $40/pound to $25/pound from January, 1980 to January, 1981 (Mining Journal, July 24, 1981). At present the outlook for the United States uranium industry is bleak. Low prices and overproduction in the industry have resulted in the closures of numerous uranium mines and mills and reduced production at properties which have remained in operation. The price of uranium at the end of 1982 was $19.75/pound of concentrate.

Oil and Gas Resources

1. Known Oil and Gas Deposits

There are no known oil and gas deposits in the GRA.

2. Known Prospects, Oil and Gas Occurrences and Petroliferous Areas

There are no known prospects, oil and gas seeps or shows in the GRA or immediate region. The GRA is situated in the petroliferous Paleozoic miogeosyncline province of the

Basin and Range. Six miles south of the GRA Texaco Inc. completed the Federal No. 1 (Locality #1 on the Oil and Gas Occurrence and Land Classification Map) at a depth of 7,030 feet in 1972 (Garside and others, 1977). There were no shows of oil or gas reported (Nevada Bureau of Mines and Geology Oil and Gas Files, 1982).

3. Oil and Gas Leases

Nearly all of the GRA has been leased for oil and gas.

4. Oil and Gas Deposit Types

Oil deposits that have been found and developed, and those that are being explored for in the Basin and Range to date, have been limited to the Upper Paleozoic section of the miogeosyncline and the Tertiary section of the intermontane basins. The source rocks are assumed to be in Paleozoic horizons, such as the Mississippian Chainman Shale, and perhaps also the Tertiary section.

The reservoirs at the Trap Spring and Eagle Springs oil fields in Railroad Valley are the Oligocene Garrett Ranch volcanics or equivalent, which produce from fracture porosity horizons; or the Eocene Sheep Pass Formation, a freshwater limestone. Minor production has been recorded from the Ely(?) Formation of Pennsylvanian age at Eagle Springs. It may be that production also comes from other units in the Tertiary or Paleozoic sections in the Blackburn oil field in Pine Valley or the Currant and Bacon Flat oil fields in Railroad Valley.

The GRA is within or close to the North American Overthrust Belt which has good oil and gas production in Wyoming/Utah, Mexico and Canada (Oil and Gas Jour., May 12, 1980). The Federal leases in Nevada are for rank wildcat acreage, and surficial stratigraphic units do not necessarily have a direct bearing on possible drilling objectives at depth, considering overthrust structural implications.

Recent seismic surveys (e.g., Seisdata Services, 1981; Geophysical Service Inc., 1981; GeoData, 1981: Index maps in GRA File) indicate, in part, the general area of industry interest. This and certain other data may be purchased, but deep exploratory test data are not readily available. Published maps of the Overthrust Belt in Nevada are very generalized, and are not necessarily in agreement because exploration is at an early stage (Oil and Gas Jour., May 12, 1980; Western Oil Reporter, June, 1980; Keith, 1979: Index maps in GRA File).

5. Oil and Gas Economics

The low level of production from Nevada Basin and Range oil fields, which are remote from existing pipelines, existing refineries and consuming areas, necessitates the trucking of the crude oil to existing refineries in Utah, California and Nevada. Since the discovery of oil in Nevada in 1953, the level of production has fluctuated. Factors which have affected the production from individual wells are: reservoir and oil characteristics; Federal regulations; productivity; environmental constraints; willingness or ability of a refiner to take certain types of oil; and of course, the price to the producer, which is tied to regional, national and international prices.

Geothermal Resources

1. Known Geothermal Deposits

There are no known geothermal deposits in the GRA or surrounding valleys.

2. Known Prospects, Geothermal Occurrences, and Geothermal Areas

There are no known prospects or occurrences in the GRA, but it is located in a part of the Basin and Range province that has shallow, often high volume, low-temperature resources.

3. Geothermal Leases

There are no geothermal leases in the GRA or the region around it.

4. Geothermal Deposit Types

Geothermal resources are hot water and/or steam which occur in subsurface reservoirs or at the surface as springs. The temperature of a resource may be about 70°F (or just above average ambient air temperature) to well above 400°F in the Basin and Range province.

The reservoirs may be individual faults, intricate fault-fracture systems, or rock units having intergranular permeability -- or a combination of these. Deep-seated normal faults are believed to be the main conduits for the thermal waters rising from thousands of feet below in the earth's crust.

The higher temperature and larger capacity resources in the Basin and Range are generally hydrothermal convective systems. The lower temperature reservoirs may be individual faults bearing thermal water or lower pressured, permeable rock units fed by faults or fault systems. Reservoirs are present from the surface to over 10,000 feet in depth.

5. Geothermal Economics

Geothermal resources are utilized in the form of hot water or steam normally captured by means of drilling wells to a depth of a few feet to over 10,000 feet in depth. The fluid temperature, sustained flow rate and water chemistry characteristics of a geothermal reservoir, as well as the end use, determine the depth to which it will be economically feasible to drill and develop each site.

Higher temperature resources (above 350°F) are currently being used to generate electrical power in Utah and California, and in a number of foreign countries. As fuel costs rise and technology improves, the lower temperature limit for power will decrease appreciably -- especially for remote sites.

All thermal waters can be beneficially used in some way, including fish farming (68°F), warm water for year around mining in cold climates (86°F), residential space heating (122°F), greenhouses by space heating (176°F), drying of vegetables (212°F), extraction of salts by evaporation and crystallization (266°F), and drying of diatomaceous earth (338°F). These are only a few examples.

Unlike most mineral commodities remoteness of the resource location is not a drawback. Domestic and commercial use of natural thermal springs and shallow wells in the Basin and Range province is a historical fact for over 100 years.

Development and maintenance of a resource for beneficial use may mean no dollars or hundreds of millions of dollars, depending on the resource characteristics, the end use and the intensity or level of use.

D. OTHER GEOLOGICAL RESOURCES

There are no other unusual or special geological resources known to exist in the GRA. Coal is not known in the GRA, and there is no known potential for coal.

E. STRATEGIC AND CRITICAL MINERALS AND METALS

A list of strategic and critical minerals and metals provided by the BLM was used as a guideline for the discussion of strategic and critical materials in this report.

The Stockpile Report to the Congress, October 1981-March 1982, states that the term "strategic and critical materials" refers to materials that would be needed to supply the industrial, military and essential civilian needs of the United States during a national emergency and are not found or produced in the United States in sufficient quantities to meet such need. The report does not define a distinction between strategic and critical minerals.

There are no strategic and critical minerals known to exist in the GRA.

IV. LAND CLASSIFICATION FOR G-E-M RESOURCES POTENTIAL

The geologic maps which cover the WSAs include Tschanz and Pampeyon's (1970) county geologic map and Howard (1978), both at a scale of 1:250,000 and both essentially the same for the Delamar Mountains. The scale of these maps is too small to show much detail and areas of alteration, if present, are not included. The Kane Springs Wash Caldera complex was not recognized on either of these maps but is shown on both Stewart and Carlson's (1976, 1978) state geologic map and "Cenozoic Rocks of Nevada" map, at even smaller scales. There is very little data on mineral occurrences in this area except for Tschanz and Pampeyan (1970) and here the data on the Delamar Range suggests no mineralization at all. Overall the quantity of geological data available is limited with more detail needed, but the quality of the available information is high.

Land classification areas are numbered starting with the number 1 in each category of resources. Metallic mineral land classification areas have the prefix M, e.g., M1-4D. Uranium and thorium areas have the prefix U. Nonmetallic mineral areas have the prefix N. Oil and gas areas have the prefix OG. Geothermal areas have the prefix G. Sodium and potassium areas have the prefix S. The saleable resources are classified under the nonmetallic mineral resource section. Both the Classification Scheme, numbers 1 through 4, and the Level of Confidence Scheme, letters A, B, C and D, as supplied by the BLM are included as attachments to this report. These schemes were used as strict guidelines in developing the mineral classification areas used in this report.

Land classifications have been made here only for the areas that encompass segments of the WSAs. Where data outside a WSA has been used in establishing a classification area within a WSA, then at least a part of the surrounding area may also be included for clarification. The classified areas are shown on the 1:250,000 mylars or the prints of those that accompany each copy of this report.

In connection with nonmetallic mineral classification, it should be noted that in all instances areas mapped as alluvium are classified as having moderate favorability for sand and gravel, with moderate confidence, since alluvium is by definition sand and gravel. All areas mapped as principally limestone or dolomite have a similar classification since these rocks are usable for cement or lime production. All areas mapped as other rock, if they do not have specific reason for a different classification, are classified as having low favorability, with low confidence, for nonmetallic mineral potential, since any mineral material can at least be used in construction applications.

1. LOCATABLE RESOURCES

a. Metallic Minerals

WSA NV 050-0177

M1-1B. This classification area includes all the Paleozoic rocks near the southern edge of the Delamar range. There are no known deposits or occurrences of metallic mineral resources, though metallic resources do exist in similar units in eastern Nevada. The 1 classification indicates no evidence indicating favorability for metallic minerals. The low confidence level B indicates that the absence of any indication of mineralization is indirect evidence for the 1 classification.

M2-2A. This classification area of low favorability with a very low confidence level includes all the area covered by Tertiary volcanics in the WSA. There are no reported metallic deposits or occurrences, but the nature of the underlying Paleozoic sediments is unknown. The Delamar mining district to the north was a major precious metals producer and the possibility exists that mineralization is also present in this area beneath the volcanic cover. In addition, caldera complexes are undergoing a great deal of interest by major mining companies at the present time as precious metal mineralization is sometimes associated with them. There is no evidence suggesting mineralization, however, therefore the very low confidence level of A. To the northeast in the Clover Mountains there has been some interest in alunite alteration in similar volcanics for the aluminum potential, but there is no other information which could possibly point to similar alteration in this GRA.

M3-2A. This classification area of low favorability with a very low confidence level includes all the area covered by alluvium in the WSA. The nature of the underlying bedrock is unknown and the 2A classification can be substantiated using the same rationale as M2-2A above.

WSA NV 050-01R-16A, NV 050-01R-16B and NV 050-01R-16C

M4-2A. This classification of low favorability with a very low confidence level includes all the bedrock exposures of Tertiary volcanics in the WSA. There have been no reported occurrences of metallic minerals, but the nature of the underlying Paleozoics is unknown; therefore, the classification rationale is the same as M2-2A above.

M3-2A. This classification covers the alluvium in the WSA and is described above under the previous WSA.

b. Uranium and Thorium

WSA NV 050-0177

U1-2B. This land classification covers most of WSA NV 050-0177 except for areas along the southwest, southeast and northern margin of the area. The area is covered mostly by Tertiary silicic tuffs, flows and related sediments. Lower Paleozoic sediments occur on the southwest margin of the WSA. The volcanics were deposited during development of the Kane Springs Wash caldera which is present in the northeastern part of the WSA (Stewart and Carlson, 1976). The emplacement of the caldera and related volcanic and sedimentary rocks and structures (ring fractures, deep-seated faults, etc.) may have provided a favorable environment for caldera-related uranium deposits such as those which occur at McDermitt, Nevada. However, the uranium content and, therefore, the source rock potential of the volcanics, is unknown. The lack of documented uranium occurrences in the area may indicate that the volcanics are not good uranium source rocks or that the area has not been explored sufficiently to locate such occurrences. If suitable source rocks are present, fracture-filling uranium deposits may also occur in the lower Paleozoic sediments adjacent to the caldera. For these reasons this area appears to have low favorability for uranium with a low confidence level.

The area has very low favorability at a low confidence level for thorium deposits due to a lack of source rocks such as pegmatites.

WSA NV 050-01R-16A, NV 050-01R-16B, NV 050-01R-16C and WSA NV 050-0177

U2-2B. This land classification covers all of three small WSAs, and the southwest, southeast and northern margins of WSA NV 050-0177. This area is covered by Quaternary alluvium and Tertiary lake deposits. The area has low favorability for epigenetic sandstone-type uranium deposits at a low confidence level due to a lack of information. Ground water may have leached uranium from the silicic tuffs and lava flows which occur marginally to the depositional basins, and could have deposited uranium where reducing conditions were encountered in the alluvial deposits.

The area has very low favorability at a low confidence level for thorium due to lack of known source rocks such as granites or pegmatites.

c. Nonmetallic Minerals

WSA NV 050-0177

N1-3C. This classification of moderate favorability with a moderate confidence level includes the outcrops of the Eureka Quartzite near the southwest corner of the range. This unit has been mined for silica sand in the past to the south in the Arrow Canyon Range. The unit is high in silica sand content therefore the 3C classification.

N2-2B. This classification area of moderate favorability with a moderate confidence level includes the remaining Paleozoic sediments along the southern Delamar Range. These units could possibly be utilized in cement or lime manufacture therefore the 3C classification.

N3-2B. This classification of low favorability with a low confidence level includes all the Tertiary volcanic bedrock outcrop areas in the WSA. Perlite is found in similar rocks in both the Pahroc Range adjacent to the north and the Meadow Valley range adjacent to the east. There is a low favorability for perlite here as little detail is known about these volcanic rocks and more detailed mapping would be necessary to further evaluate potential. In addition to the northeast in the Clover Mountains, there have been occurrences of alunite reported in similar rocks.

N4-3C. This classification includes all the alluvial material in the WSA. This material could be utilized for nearby construction purposes.

WSA NV 050-01R-16A, NV 050-01R-16B and NV 050-01R-16C

N3-2B. This classification includes the volcanic bedrock and is the same rationale as that described above in the previous WSA.

N4-3C. This classification includes the alluvium and is the same rationale as that described above in the previous WSA.

2. LEASABLE RESOURCES

a. Oil and Gas

WSA NV 050-0177

OG1-3A. This classification covers that portion of the WSA that has the Pennsylvanian/Permian miogeosyncline sediments, Tertiary volcanics and valley fill in outcrop. It is assumed that there could be a sufficient prospective stratigraphic section for the generation and entrapment of hydrocarbons.

There is a question as to whether this WSA is within the prospective Overthrust Belt, but the density of leasing indicates industry's interest in the area regardless.

OG2-2A. The central composite fault block in the WSA has Cambrian to Devonian Paleozoics exposed and Tertiary volcanics probably covering these age units elsewhere.

Commerical oil has been recovered from Upper-paleozoic age and younger rocks in Nevada. Even so, the geologic environment of these rocks, and the possibility of fracture porosity in these highly faulted units, provides at least a somewhat favorable setting. The WSA may also be within the prospective Overthrust Belt.

WSAs NV 050-01R-16A, NV 050-01R-16B and NV 050-01R-16C

OG3-3A. These WSAs are essentially contiguous with the 3A classification portion of WSA 050-0177, and the rationale for this classification is the same.

b. Geothermal

WSAs NV 050-0177, NV 050-01R-16A, NV 050-01R-16B and NV 050-01R-16C

G1-2A. There are numerous known and probable very large, deep-seated, normal faults throughout the WSAs. These faults are the type which often act as conduits for rising thermal waters. The paucity of drilling of any kind in the WSAs area may be the reason why no low-temperature resources have been encountered.

c. Sodium and Potassium

S1-1D. This classification applies to the entire WSA. There is no indication of favorability for the accumulation of resources of sodium and potassium.

3. Saleable Resources

The saleable resources, sand and gravel, have been discussed above under nonmetallics and includes classification area N4-3C.

V. RECOMMENDATIONS FOR ADDITIONAL WORK

1. More detailed mapping of the Paleozoic sediments and structure at the southwest end of the Delamar range would greatly assist in determining mineral favorability. Detailed mapping in the volcanics would also delineate any potential for perlite. Since the northeastern portion of the WSA is included as a part of the Kane Springs Wash caldera and certain caldera features are currently considered favorable for precious metals, this area deserves closer scrutiny.

2. The entire WSA is relatively little known from a geological standpoint and an effort should be made to gather more pertinent information on the entire WSA.

3. The material sites inside the western edge of WSA 050-0177 should be field checked to see if there has been any production from them.

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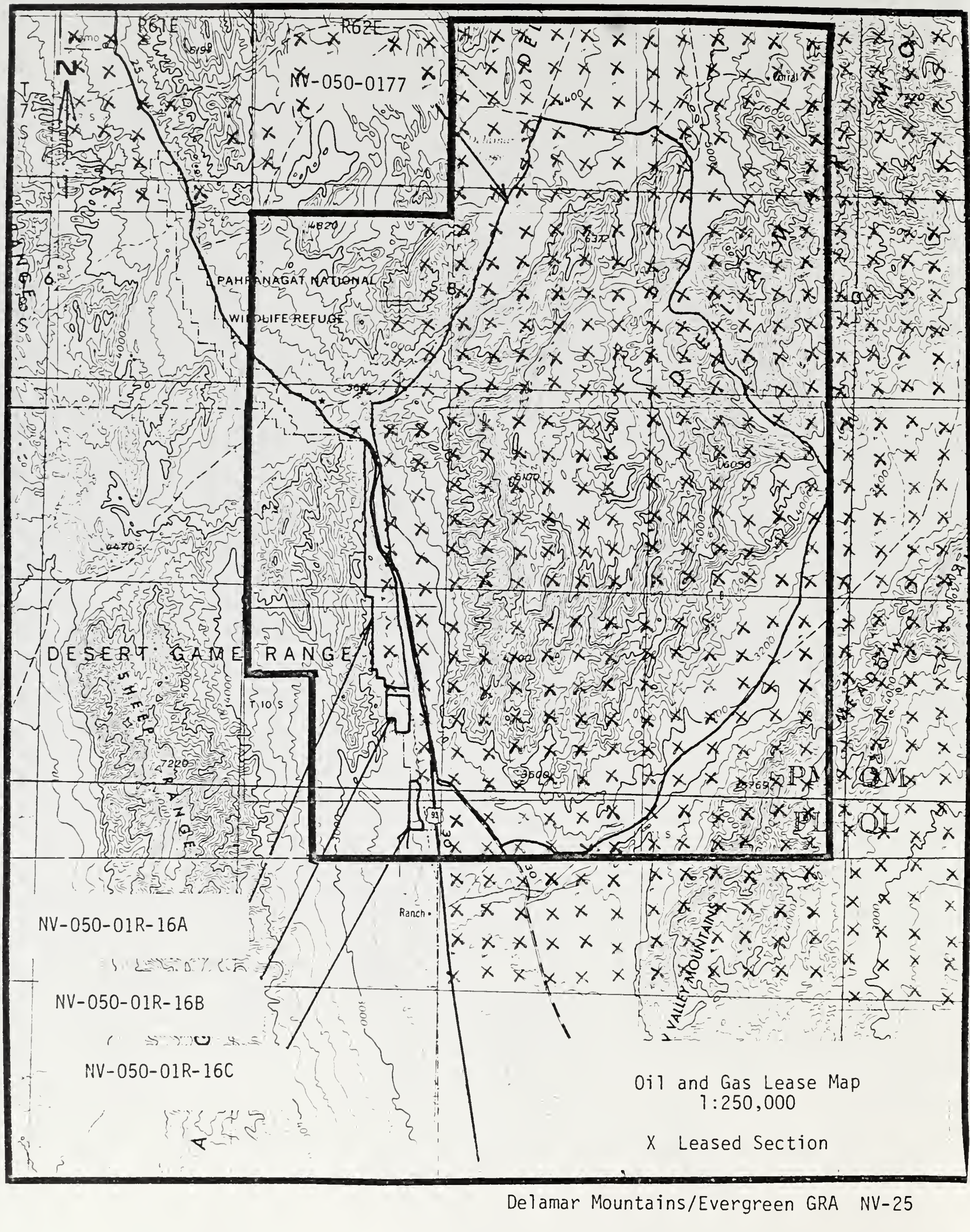
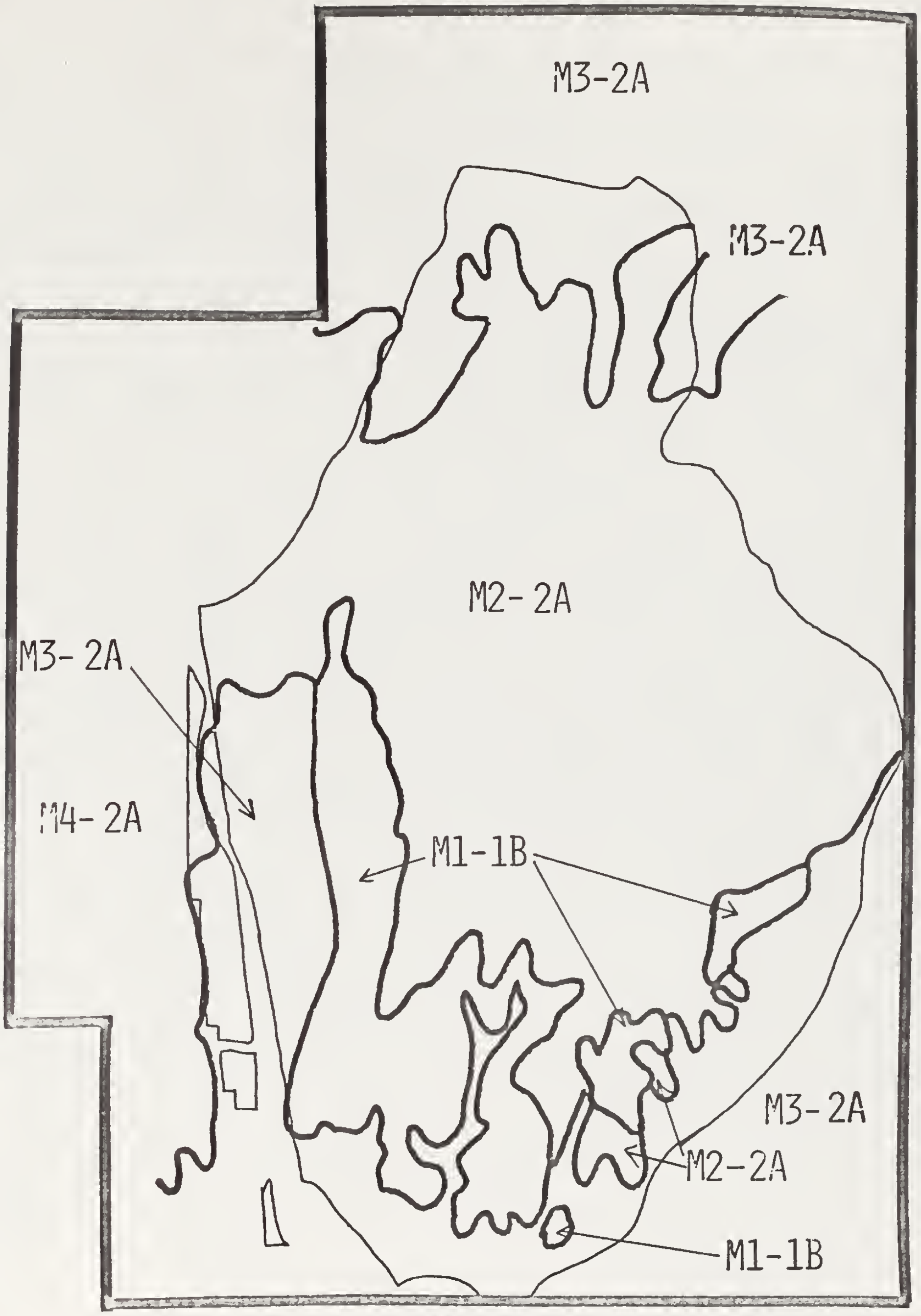


Delamar Mountains/Evergreen GRA NV-25



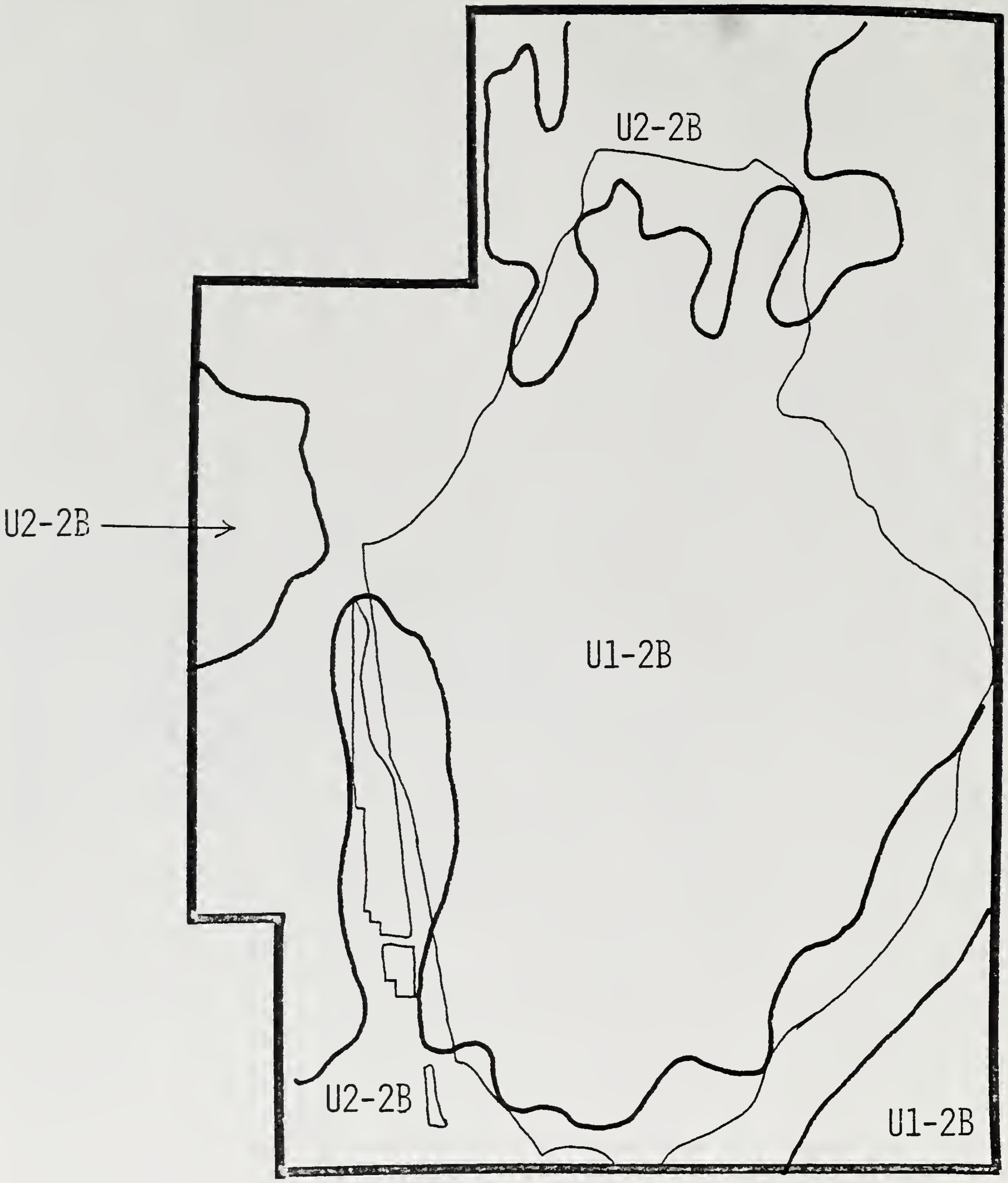
EXPLANATION

—— WSA Boundary

▬ Land Classification Boundary

Delamar Mountains/Evergreen GRA NV-25
Scale 1:250,000

Land Classification - Mineral Occurrence Map/Metallics



EXPLANATION

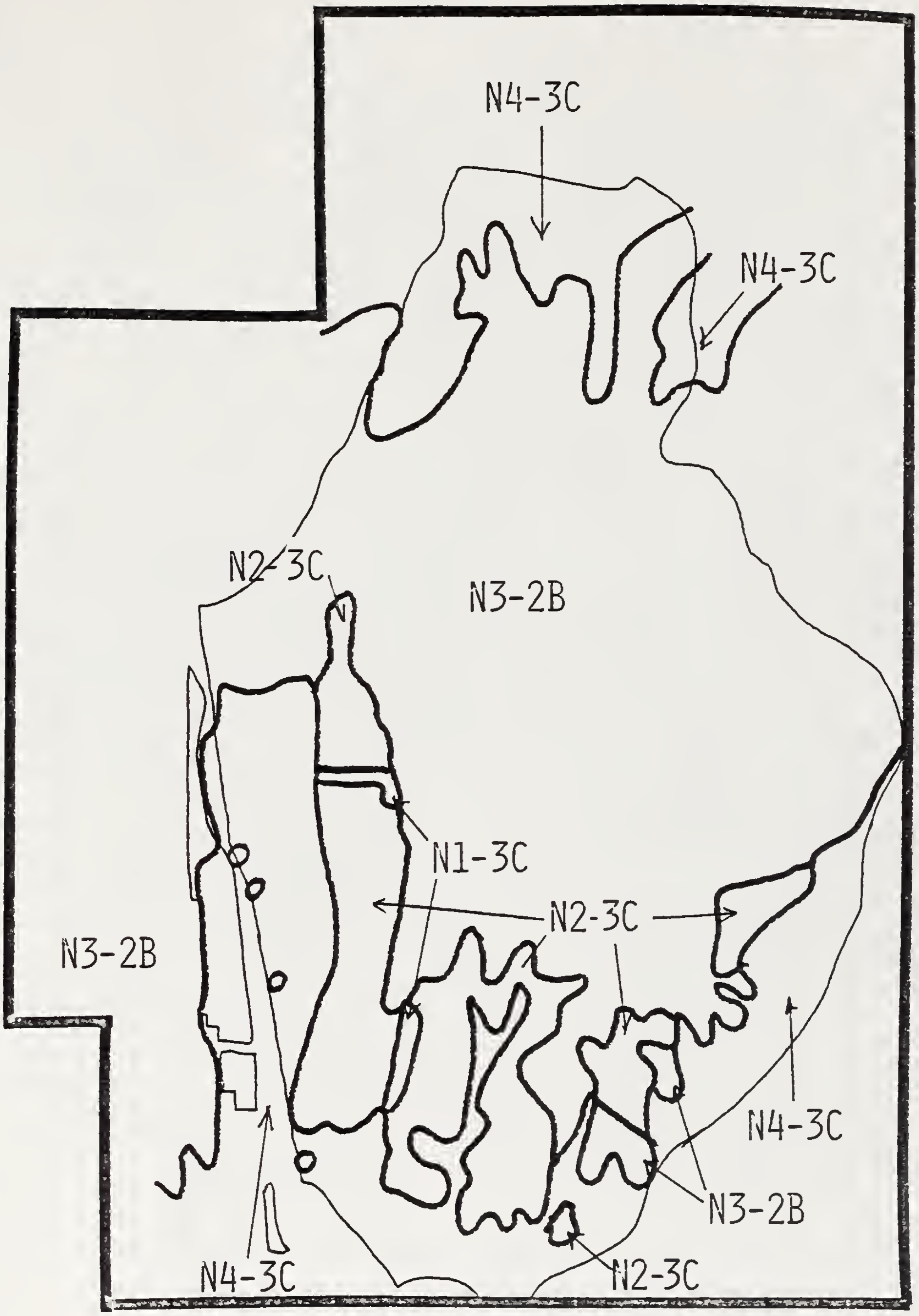
— WSA Boundary

— Land Classification Boundary

Delamar Mountains/Evergreen GRA NV-25

Scale 1:250,000

Land Classification - Mineral Occurrence Map/Uranium



EXPLANATION

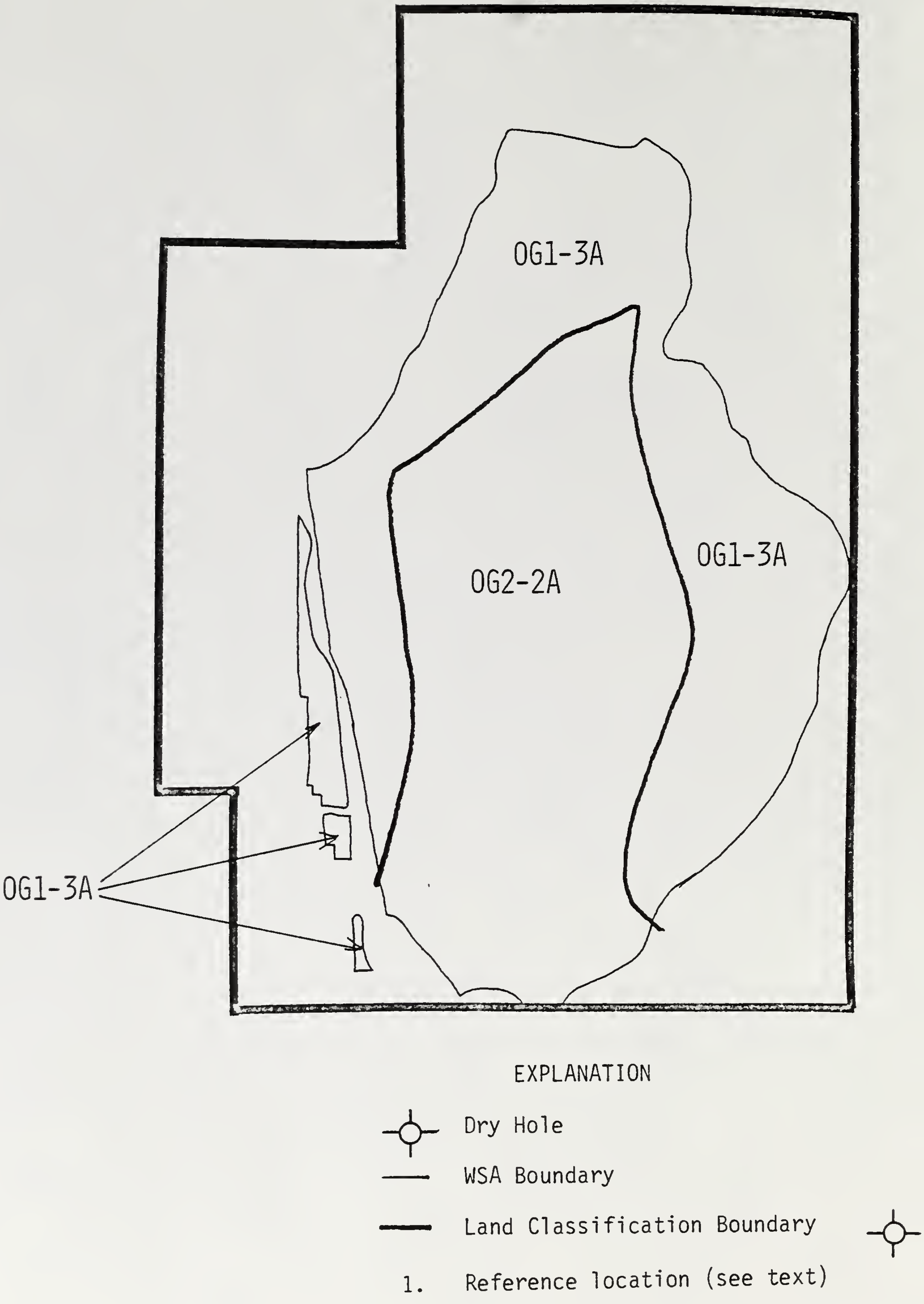
— WSA Boundary

━ Land Classification Boundary

○ Material Sites (approximate locations)

Delamar Mountains/Evergreen GRA NV-25
Scale 1:250,000

Land Classification - Mineral Occurrence Map/Nonmetallics


OG1-3A
OG1-3A
OG2-2A
OG1-3A
EXPLANATION
Dry Hole
WSA Boundary
Land Classification Boundary
1. Reference location (see text)

Delamar Mountains/Evergreen GRA NV-25
Scale 1:250,000

Land Classification - Mineral Occurrence Map/Oil and Gas

LEVEL OF CONFIDENCE SCHEME

A. THE AVAILABLE DATA ARE EITHER INSUFFICIENT AND/OR CANNOT BE CONSIDERED AS DIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES WITHIN THE RESPECTIVE AREA.

B. THE AVAILABLE DATA PROVIDE INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

C. THE AVAILABLE DATA PROVIDE DIRECT EVIDENCE, BUT ARE QUANTITATIVELY MINIMAL TO SUPPORT TO REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

D. THE AVAILABLE DATA PROVIDE ABUNDANT DIRECT AND INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

CLASSIFICATION SCHEME

1. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES DO NOT INDICATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

2. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES INDICATE LOW FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

3. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, AND THE REPORTED MINERAL OCCURRENCES INDICATE MODERATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

4. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, THE REPORTED MINERAL OCCURRENCES, AND THE KNOWN MINES OR DEPOSITS INDICATE HIGH FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

MAJOR STRATIGRAPHIC AND TIME DIVISIONS IN USE BY THE U.S. GEOLOGICAL SURVEY

Erathem or Era		System or Period	Series or Epoch	Estimated ages of time boundaries in millions of years
Cenozoic		Quaternary	Holocene	
			Pleistocene	2-3 [1]
		Tertiary	Pliocene	12 [1]
			Miocene	26 [2]
			Oligocene	37-38
			Eocene	53-54
			Paleocene	65
Mesozoic		Cretaceous [4]	Upper (Late) Lower (Early)	136
		Jurassic	Upper (Late) Middle (Middle) Lower (Early)	190-195
		Triassic	Upper (Late) Middle (Middle) Lower (Early)	225
Paleozoic		Permian [4]	Upper (Late) Lower (Early)	280
	Carboniferous Systems	Pennsylvanian [4]	Upper (Late) Middle (Middle) Lower (Early)	
		Mississippian [4]	Upper (Late) Lower (Early)	345
		Devonian	Upper (Late) Middle (Middle) Lower (Early)	395
		Silurian [4]	Upper (Late) Middle (Middle) Lower (Early)	430-440
		Ordovician [4]	Upper (Late) Middle (Middle) Lower (Early)	500
		Cambrian [4]	Upper (Late) Middle (Middle) Lower (Early)	570
Precambrian [3]			Informal subdivisions such as upper, middle, and lower, or upper and lower, or younger and older may be used locally.	3,600+ [3]

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[1] Holmes, Arthur, 1965, Principles of physical geology: 2d ed., New York, Ronald Press, p. 360-361, for the Pleistocene and Pliocene, and Obradovich, J. D., 1965, Age of marine Pleistocene of California: Am. Assoc. Petroleum Geologists, v. 49, no. 7, p. 1087, for the Pleistocene of southern California.

[2] Geological Society of London, 1964, The Phanerozoic time-scale; a symposium: Geol. Soc. London, Quart. Jour., v. 120, supp., p. 260-262, for the Miocene through the Cambrian.

[3] Stern, T. W., written commun., 1968, for the Precambrian

[4] Includes provincial series accepted for use in U.S. Geological Survey reports.

Terms designating time are in parentheses. Informal time terms early, middle, and late may be used for the eras, and for periods where there is no formal subdivision into Early, Middle, and Late, and for epochs. Informal rock terms lower, middle, and upper may be used where there is no formal subdivision of a system or of a series.

GEOLOGIC NAMES COMMITTEE, 1970